ONTARIO MINISTRY OF THE ENVIRONMENT

Water Resources Branch

GROUND WATER PROBABILITY
COUNTY OF BRANT

Descriptive Notes

Introduction

Ground water in the County of Brant is an important resource used extensively for agricultural, municipal, industrial and domestic purposes. The availability of ground water, however, is not uniform throughout the county and in some areas this could limit the future expansion of existing activities and restrain future land-use development. This publication was designed to provide an insight into ground-water availability patterns in the county and to provide essential information on which planning for future water-resource development can be based.

The maps in this publication describe ground-water availability in terms of probable quantity of water, depth at which water is commonly found, and water quality at sampled locations. Because of the complexity of ground-water occurrence in the county, the foregoing information is presented on three map sheets:

Sheet 1: Supplies in overburden
Sheet 2: Supplies in bedrock
Sheet 3: Water quality

Hydrogeologic interpretations have been based on data obtained from over 1700 water-well records on file with the Ontario Ministry of the Environment, and from past documented studies of ground-water availability in various parts of the county. The appropriate references are listed on each map sheet. The reliability of the interpretations vary throughout the county and a periodic updating or revision of the present interpretations may be necessary as new hydrogeologic information becomes available.

Evaluation of Prospective Well Sites

A step-by-step procedure is presented to determine the availability of ground water at a prospective well site in terms of probable yields, the likely depth of the water-bearing zone, and the likely water quality. This information can subsequently be used in other considerations such as: well costs, methods of well construction, pump type and possible water treatment. The maps should be used in the suggested sequence in order to obtain the most economical wells. Map 1 indicates yields from the shallowest formations and should be consulted first. Progressively deeper and more costly wells will have to be constructed as water is sought from deeper formations in order to obtain the yields indicated on maps 2 and 5.

To evaluate yields:

1. locate the well site on Map 1 of Sheet 1 (Yields from Overburden within 60 Feet of Surface);
2. note the colour of the map at the well site;
3. refer to the legend and relate the colour to the appropriate probable yield;
4. if the probable yield does not meet your water requirements, repeat steps one through three using Map 2 (Yields from Overburden between 60 Feet from Surface and Bedrock). Similarly, if the probable yield determined from Map 2 is insufficient, repeat the same steps using Map 5 on Sheet 2 (Yields from Bedrock).

To evaluate the depths to water-bearing zones:

5. if Map 1 was selected in the above steps, water-bearing zones occur within 60 feet of surface;
   if Map 2 was selected, locate the well site on Map 3 and note the depths to the water-bearing zones by using the colour-coded legend;
   if Map 5 was selected, locate the well site on Map 6 and note the depths to the water-bearing zones by using the colour-coded legend;
6. the exact depths to water-bearing zones for individual wells are shown on maps 1, 2 and 5.

To evaluate water quality:

7. to evaluate the likely ground-water quality at a potential well site, locate the well on the selected yield map and note the nearby ground-water sampling points. The chemical analyses of these samples are found on Sheet 3 in the Inorganic Chemical Analyses tables 1, 2 and 3.

Ground-Water Yield

The probable quantity of water available to wells in shallow overburden, deep overburden and bedrock is shown in maps 1, 2 and 5, respectively. These maps indicate probable yields of less than 2 gpm (gallons per minute), 2-10 gpm, 10-50 gpm, and greater than 50 gpm. Because of variations in the local hydrogeology, type of well construction, and in the reliability of available data, the probable well yields indicated on the maps may not everywhere represent yields available to all wells. However, the indicated yields are thought to be good approximations in most areas. In cases where reliable, long-term yields are sought, it is necessary to undertake detailed hydrogeologic investigations and pumping tests.

In shallow overburden (Map 1), only yields of less than 2 gpm and 2-10 gpm are indicated since significant areas of higher yields are not present. Most wells in shallow overburden in the eastern half of the county are likely to yield less than 2 gpm, and may not supply sufficient water when pumped for even short periods of time. A more sustained yield can be achieved by the use of large-diameter, bored wells since they can store larger amounts of water than ordinary drilled wells. Even so, only modest water demands can be satisfied by shallow bored wells in the eastern half of the county, especially during low water-level periods in the summer.

Adequate domestic supplies of 2-10 gpm are readily available in the western half of the county. These supplies are generally obtained from surface or near-surface sand and gravel deposits using dug, bored or shallow drilled wells and single sand-point systems. Supplies of 2-10 gpm can also be obtained from gravels on bedrock located in the New Durham-Harley area of Burford Township, and in the Oshweken area of Tuscarora Township. Higher well yields for irrigation can usually be supplied by a number of shallow sand-point systems.

In deep overburden (Map 2), large areas of less than 2 gpm are located in the townships of Burford, Onondaga and Tuscarora, and are due to relatively impermeable overburden materials and limited overburden thickness. These areas have had generally little ground-water exploration and may contain undiscovered sources of higher yields. Areas of 10-50 gpm, and greater than 50 gpm, occur in the county but are unevenly distributed.

Most wells in bedrock (Map 5) are likely to yield at least 2-10 gpm, but many bedrock wells obtain water of poor quality. Areas of higher probable yields exist throughout the county, particularly in southern Oakland and Burford townships.

Depths to Water-Bearing Zones

Depths to water-bearing zones maps (maps 3 and 6) indicate the depths at which wells can obtain the yields reported on maps 2 and 5.

Most water-bearing zones in deep overburden (Map 3) are found within an interval of 61-100 feet from the surface. Deeper zones within intervals of 101-150 and 151-200 feet are frequent in South Dumfries and in the northern part of Burford Township.

In bedrock (Map 6), most water supplies are obtained from water-bearing fissures found within the first 20 feet of bedrock. The deepest water-bearing zones occur most frequently in South Dumfries Township (251 to 300 feet), and the shallowest zones occur in Burford, Onondaga and Tuscarora townships (less than 60 feet).

Overburden Thickness

Areas of notably thin overburden (less than 60 feet) are present in western Burford, eastern Tuscarora and Onondaga townships, in the northeast corner of South Dumfries township, and along the Grand River. Overburden is thickest in the northern part of South Dumfries Township (250 to 300 feet).

Bedrock Geology and Topography

Bedrock geology, as described by Sanford (1969), is predominantly limestone and dolomite with some shale.

Although bedrock topography is somewhat irregular, bedrock surface elevation generally increases towards the north and west. In the north, bedrock surface elevations reach a high in excess of 800 feet in two small areas north of St. George, in South Dumfries Township. In the west, elevations over 850 feet are present in the northwestern corner of Burford Township.

Two major bedrock topographic features in the county are the Onondaga Escarpment and the Dundas Valley. The Onondaga Escarpment enters the Township of Oakland between elevations of 650-720 feet and trends northwest-southeast in the area, becoming less defined as it extends into Burford township. The location of the Dundas Valley is indicated by the 575-

foot contours north of Langford, where it enters Brantford Township as two poorly-defined segments. One segment extends west to the Grand River northeast of Paris, and the other segment has been interpreted to extend to a bedrock depression southwest of the City of Brantford.

Water Quality

Ground-water quality in overburden is generally good, although much of the water is very hard; ground water from bedrock, as well as from overburden close to bedrock, is often of poor quality. Sulphurous water is obtained frequently from both of the latter sources and is recognized by its distasteful 'rotten-egg' smell (hydrogen sulphide gas). Sulphurous water may also contain high concentrations of sulphate which can have laxative effects on people unaccustomed to the water.

The inorganic chemical quality of ground water at any location in the county can be estimated by inspecting the analyses of nearby ground-water samples shown in tables 1, 2 and 3 on Sheet 3 (locations of samples are shown on maps 1, 2 and 5). The samples were taken from selected overburden and bedrock wells and indicate the quality of ground water in the common water-bearing zones in different parts of the county.

Of the 105 samples taken, 34 were obtained from overburden wells within 60 feet of surface (Table 1), 26 samples were taken from overburden wells between 60 feet from surface and bedrock (Table 2), and 45 samples indicate water quality in bedrock (Table 3).

The following common inorganic water quality criteria are contained in the Ontario Ministry of the Environment publication "Guidelines and Criteria for Water Quality Management in Ontario, 1974". These criteria are maximum concentrations that are recommended for public and private ground-water supplies, and for livestock use. While the criteria should generally be adhered to, slight excesses are usually not harmful. In cases where the quality of the water supply is in doubt, local health authorities should be consulted.

A. Public Supplies

Constituent	Permissible Criteria (mg/l)
Boron (B)	1.0
Chloride (Cl)	250
Fluoride (F)	2.4
Hydrogen Sulphide (H_2S)	0.1
Iron (Fe)	0.3
Nitrate (N)	10
Sulphate (SO_4)	250
Total Dissolved Solids	500
pH	6.0-8.5

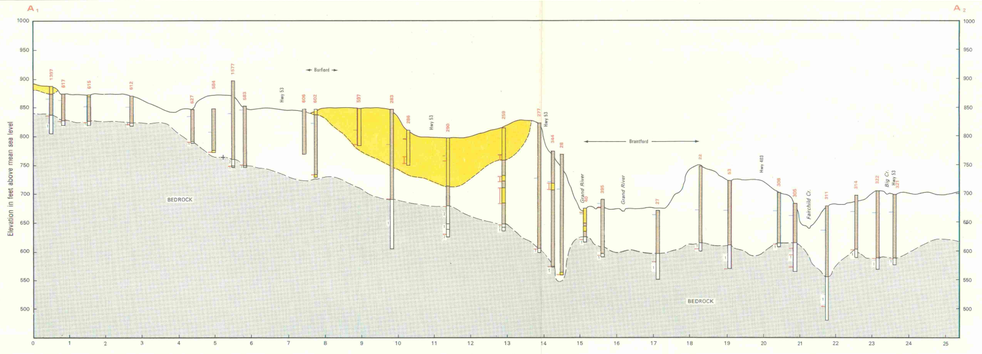
B. Livestock

Constituent	Permissible Criteria (mg/l)
Flouride (F)	2.4
Nitrate (N)	20
Sulphate (SO_4)	1000
Total Dissolved Solids	2500

Sulphurous Water in Bedrock Wells

The occurrence of sulphurous water in the county is erratic, but it can be assumed that if an area on Map 8 has no record of sulphurous wells, it is likely that a proposed well drilled into bedrock will also not obtain sulphurous water. However, it is possible that some wells with sulphurous water may not have been recorded, and therefore, there may be actually more sulphurous wells than those shown on the map.

The depths from the top of bedrock to the sulphurous water-bearing zones are highly variable and have no discernible trends in the county. However, in an effort to avoid sulphurous water, adequate supplies should first be sought from overburden. If this is not possible, ground water in bedrock should be sought at depths shallower than nearby wells reporting sulphurous waters.



CROSS SECTION $A_1 - A_2$

LEGEND FOR CROSS SECTIONS

- Sand and/or gravel
- Clay, silt, fine sand, clay and stones
- Limestone
- Shale
- Water well
- Flowing well
- Location of static water level
- Location of top of water-bearing zone
- Thickness of water-bearing zone
- Bedrock surface data, obtained from oil and gas well records
- 422 — Water well number

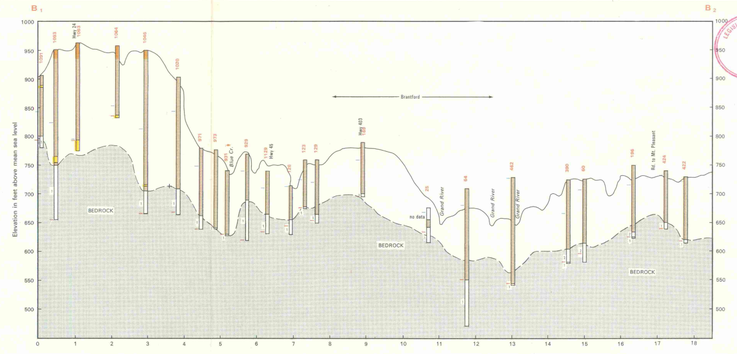
Horizontal scale 1:100,000 — Vertical scale 1 inch=100 feet

Note: Wells shown above or below ground level have been projected onto the line of cross section

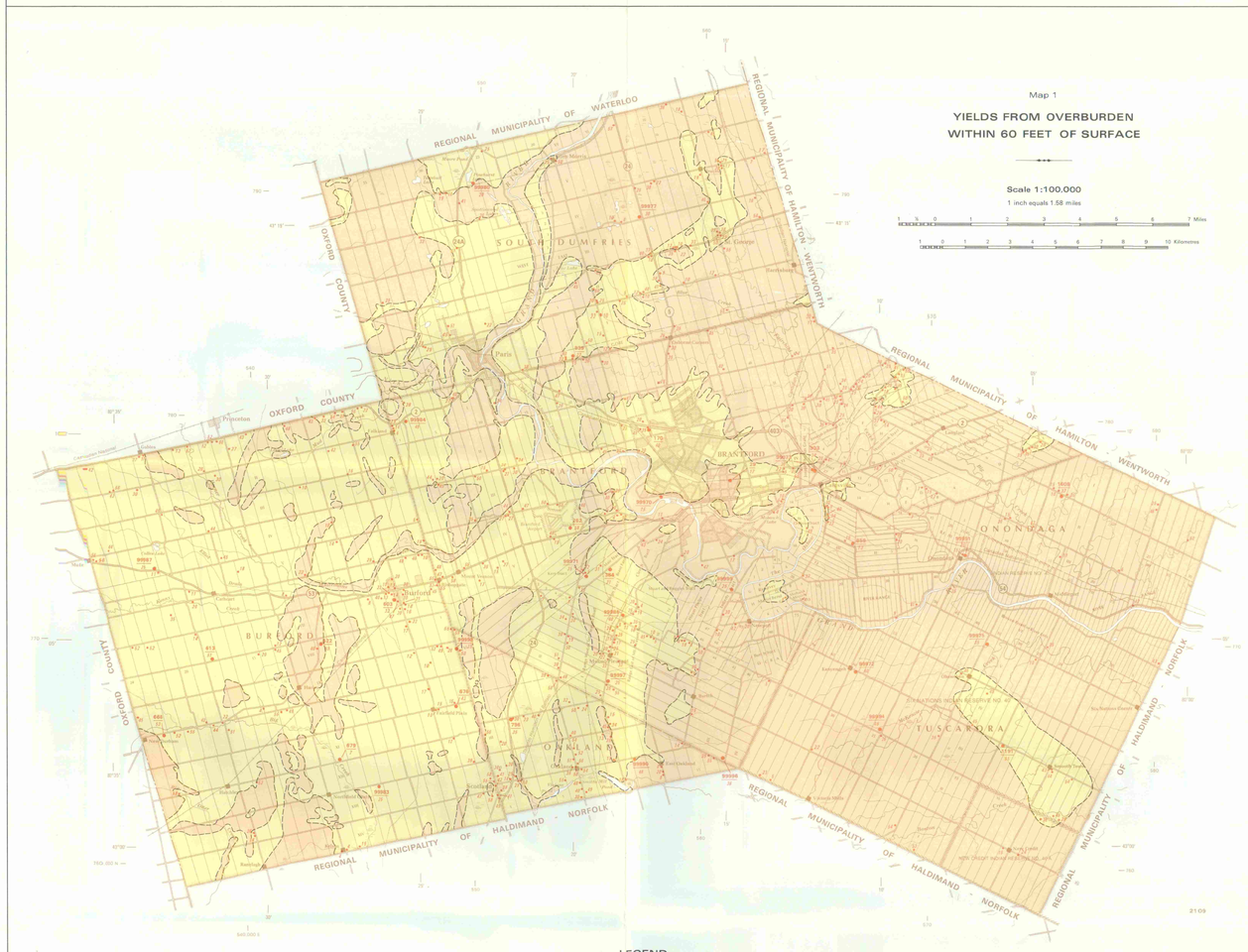
Location of the cross sections is shown on Map 2

Well log information derived from water-well records on file with the Ministry of the Environment up to the end of 1972, and from oil- and gas-well records on file with the Ministry of Natural Resources up to the end of 1972

Cross section compilation and interpretation by A. Hickinbotham



CROSS SECTION $B_1 - B_2$



Map 1

YIELDS FROM OVERBURDEN WITHIN 60 FEET OF SURFACE

Scale 1:100,000

1 inch equals 1.58 miles

1 ½ 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 10 Kilometres

LEGEND

- Area where wells (mostly dug wells) are likely to yield less than 2 gallons per minute; difficulties are encountered in obtaining sufficient quantities of water for any purpose
- Area where wells are likely to yield up to approximately 10 gallons per minute in water-bearing sand and/or gravel; wells in some areas of thick saturated gravels near surface are likely to produce up to 50 gpm; supply of water is adequate for domestic and stock purposes
- × 17 — Overburden well indicating depth to top of water-bearing zone (in feet)
- 22/27 — Ground-water sample location: sample or well number / depth to top of water-bearing zone (in feet)

Water sample analyses are shown in Table 1

Map compilation and interpretation by A. Hickinbotham

References:

Chapman, L.J. and Putnam, D.F., 1972, Map 2226 — Physiography of the south-central portion of southern Ontario: Ont. Dept. Mines and Northern Affairs, Ont., Res. Found.

Cowan, W. R., 1972, Pleistocene geology of the Brantford area, southern Ontario: Ont. Dept. Mines and Northern Affairs, Ind. Min. Repr. 37

Karrow, P.F., 1963, Map 2010 in Pleistocene geology of the Hamilton-Galt area, Ontario: Ont. Dept. Mines, Geol. Rept. 16

Ontario Water Resources Commission, 1966, Middle Grand River region water supply study

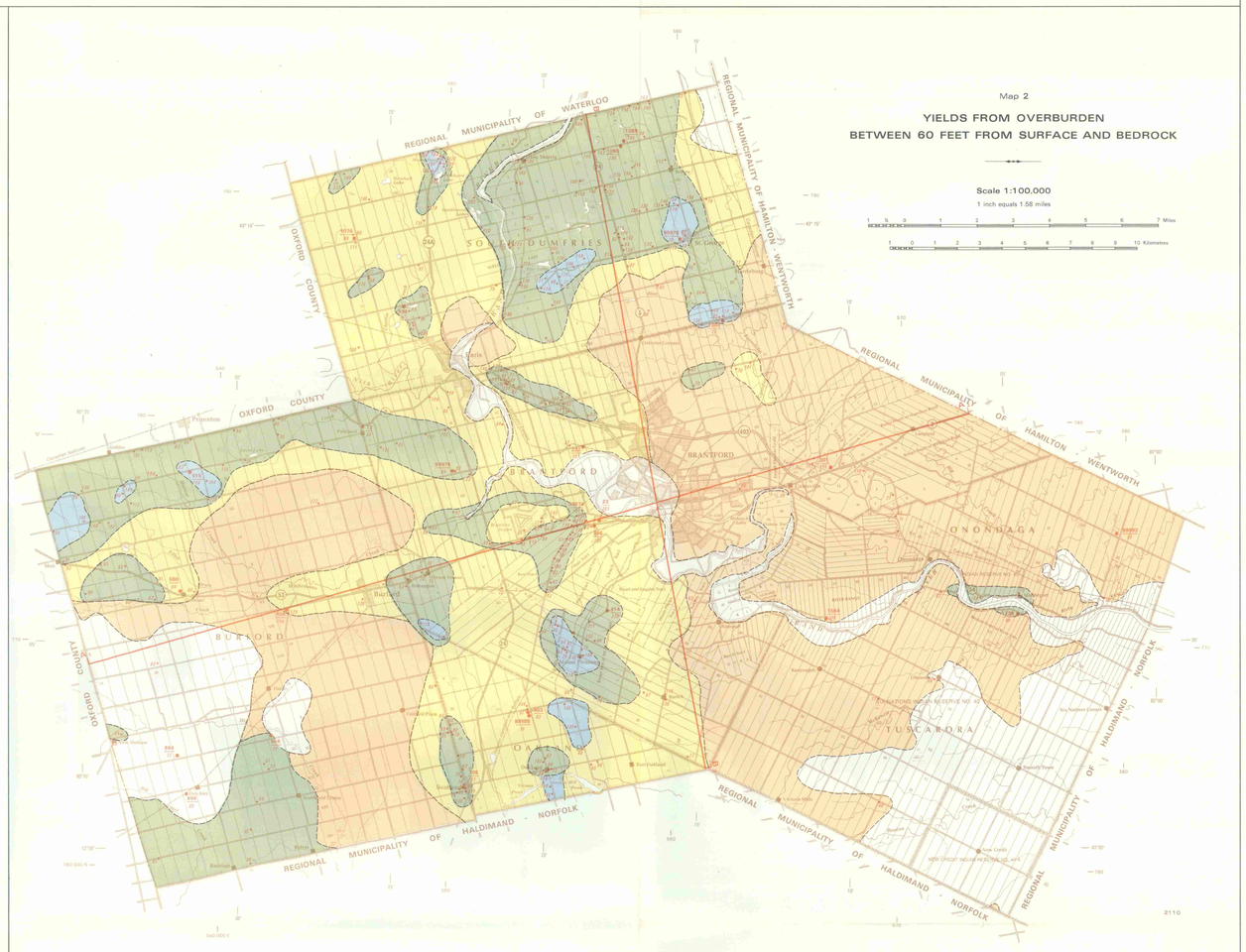
———— 1964, Report on water resources survey, County of Brant

Sibul, U., 1969, Water resources of the Big Otter Creek drainage basin: Ont. Water Resour. Comm., Water Resour. Rept. 1

Yakutchik, T.J., and Lammers, W., 1970, Water resources of the Big Creek drainage basin: Ont. Water Resour. Comm., Water Resour. Rept. 2

Hydrogeologic information derived from water-well records on file with the Ontario Ministry of the Environment up to the end of 1972

Cartography by B. Fischer and R. Zimmermann



Map 2

YIELDS FROM OVERBURDEN BETWEEN 60 FEET FROM SURFACE AND BEDROCK

Scale 1:100,000

1 inch equals 1.58 miles

1 ½ 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 10 Kilometres

LEGEND

- Area where wells are likely to yield less than 2 gallons per minute; difficulties are encountered in obtaining sufficient quantities of water for any purpose
- Area where wells are likely to yield 2 to 10 gallons per minute; supplies are generally adequate for domestic and stock purposes
- Area where wells are likely to yield 10 to 50 gallons per minute; supplies are generally plentiful for domestic and stock purposes, adequate for most commercial and small industrial purposes, but generally poor to fair as a source for irrigation
- Area where wells are likely to yield more than 50 gallons per minute; supplies are generally adequate for most purposes
- Area in which overburden is generally less than 60 feet thick; refer to Map 1 for information on likely well yields
- × 135 — Overburden well indicating depth to top of water-bearing zone (in feet)
- 22/27 — Ground-water sample location: sample or well number / depth to top of water-bearing zone (in feet)

Water sample analyses are shown in Table 2

A_1 A_2 — Line of cross section

Map compilation and interpretation by V. Novicki and A. Hickinbotham

References:

Ontario Water Resources Commission, 1966, Middle Grand River region water supply study

———— County of Brant ———— 1964, Report on water resources survey,

Sibul, U., 1969, Water resources of the Big Otter Creek drainage basin: Ont. Water Resour. Comm., Water Resour. Rept. 1

Yakutchik, T.J., and Lammers, W., 1970, Water resources of the Big Creek drainage basin: Ont. Water Resou. Comm., **Water Resour. Rept. 2**

Hydrogeologic information derived from water-well records on file with the Ontario Ministry of the Environment up to the end of 1972

Cartography by B. Fischer and R. Zimmermann

LEGEND

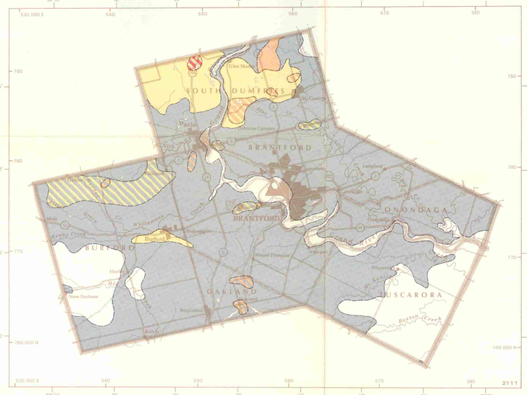
- Area in which overburden is generally less than 60 feet thick; refer to maps 1 and 2 regarding depths at which wells obtain water at specific sites within this area
- Area in which most overburden wells obtain water between 60-100 feet below ground surface
- Area in which most overburden wells obtain water between 101-150 feet below ground surface
- Area in which most overburden wells obtain water between 151-200 feet below ground surface
- Area in which most overburden wells obtain water between 60-100 and between 101-150 feet below ground surface
- Area in which most overburden wells obtain water between 60-100 and between 151-200 feet below ground surface
- Area in which most overburden wells obtain water between 101-150 and between 151-200 feet below ground surface
- Area in which most overburden wells obtain water between 101-150 and between 201-250 feet below ground surface

Note: Exact depths at which water has been found in selected overburden wells are shown on maps 1 and 2

Map compilation and interpretation by A. Hickinbotham and N. Novicki

Hydrogeologic information derived from water-well records on file with the Ontario Ministry of the Environment up to the end of 1972

Cartography by B. Fischer



Map 3

DEPTHS TO WATER-BEARING ZONES IN OVERBURDEN BETWEEN 60 FEET FROM SURFACE AND BEDROCK

Scale 1:250,000

1 inch equals approximately 4 miles

5 0 5 10 Miles

5 0 5 10 Kilometres

LEGEND

- ~200' — Line of equal overburden thickness (60, 100, 150, 200, 250 feet)

Map compilation and interpretation by V. Novicki and A. Hickinbotham

References:

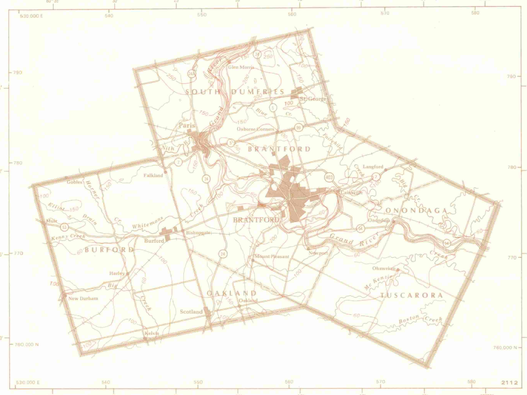
Ontario Ministry of the Environment, 1974, Ground water probability, County of Haldimand: Water Resour. Map 3112

Sibul, U., 1969, Water resources of the Big Otter Creek drainage basin: Ont. Water Resour. Comm., Water Resour. Rept. 1

Yakutchik, T.J., and Lammers, W., 1970, Water resources of the Big Creek drainage basin: Ont. Water Resour. Comm., Water Resour. Rept. 2

Hydrogeologic information derived from water-well records on file with the Ontario Ministry of the Environment up to the end of 1972

Cartography by B. Fischer



Map 4

OVERBURDEN THICKNESS

Scale 1:250,000

1 inch equals approximately 4 miles

5 0 5 10 Miles

5 0 5 10 Kilometres

Ontario

MINISTRY OF THE ENVIRONMENT
Water Resources Branch

COUNTY OF BRANT

Map 3100

GROUND WATER PROBABILITY

Sheet 1

WATER SUPPLIES IN OVERBURDEN

LEGEND

- Area where wells are likely to yield less than 2 gallons per minute; difficulties are encountered in obtaining sufficient quantities of water for any purpose
- Area where wells are likely to yield 2 to 10 gallons per minute; supplies are generally adequate for domestic and stock purposes
- Area where wells are likely to yield 10 to 50 gallons per minute; supplies are generally plentiful for domestic and stock purposes, adequate for most commercial and small industrial purposes, but poor to fair as a source for irrigation
- Area where wells are likely to yield more than 50 gallons per minute; supplies are generally adequate for most purposes
- Bedrock well indicating depth to top of water-bearing zone (in feet)
- Bedrock well with exact depth to water-bearing zone not known; number indicates depth to top of rock; water-bearing zone occurs below this depth
- Dry bedrock well; bedrock penetration (in feet)
- Ground-water sample location: *sample or well number* / depth to top of water-bearing zones (in feet)

Water sample analyses are shown in Table 3

Map compilation and interpretation by A. Hickinbotham and V. Novicki

References:

Ontario Water Resources Commission, 1966, Middle Grand River region water supply study

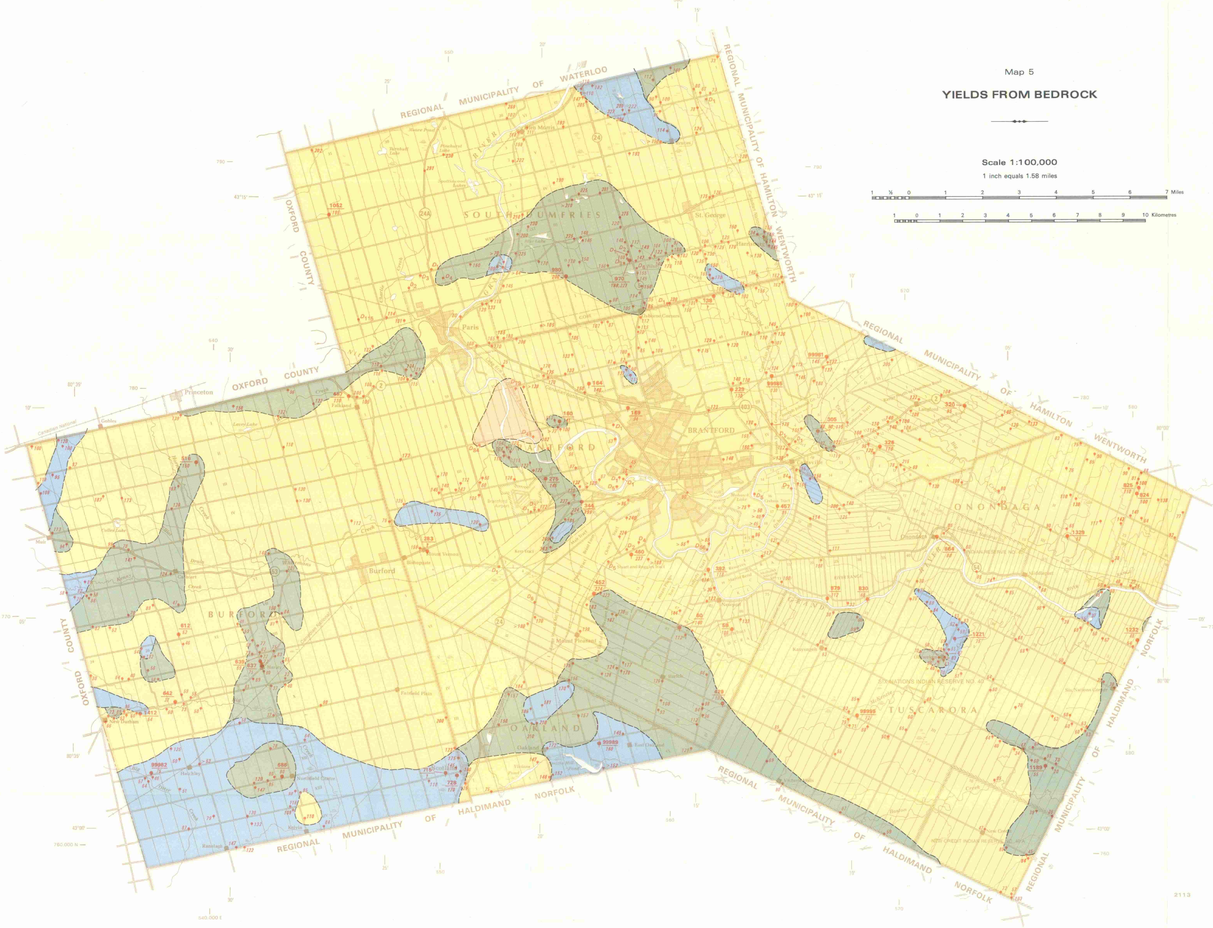
_____1964, Report on water resources survey, County of Brant

Sibul, U., 1969, Water resources of the Big Otter Creek drainage basin; Ont. Water Resour. Comm., Water Resour. Rept. 1

Yakutchik, T. J., and Lammers, W., 1970, Water resources of the Big Creek drainage basin; Ont. Water Resour. Comm., Water Resour. Rept. 2

Hydrogeologic information derived from water-well records on file with the Ontario Ministry of the Environment up to the end of 1972

Cartography by B. Fischer and R. Zimmermann



Map 5

YIELDS FROM BEDROCK

Scale 1:100,000

1 inch equals 1.58 miles

1 ½ 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 10 Kilometres

LEGEND

- Area in which most bedrock wells obtain water between ground surface and 60 feet in depth
- Area in which most bedrock wells obtain water between 61-100 feet below ground surface
- Area in which most bedrock wells obtain water between 101-150 feet below ground surface
- Area in which most bedrock wells obtain water between 151-200 feet below ground surface
- Area in which most bedrock wells obtain water between 201-250 feet below ground surface
- Area in which most bedrock wells obtain water between 251-300 feet below ground surface

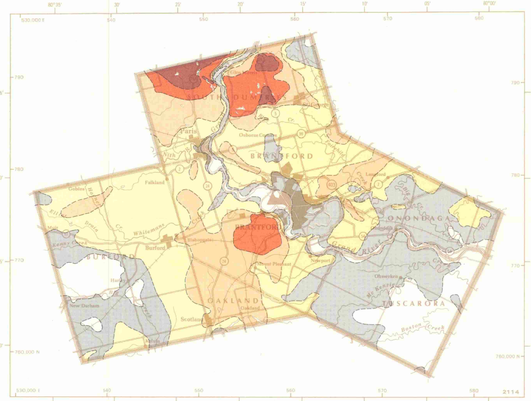
Note: Exact depths at which water has been found in specific bedrock wells are shown on Map 5

References:

Map compilation and interpretation by A. Hickinbotham and V. Novicki

Hydrogeologic information derived from water-well records on file with the Ontario Ministry of the Environment up to the end of 1972

Cartography by B. Fischer



Map 6

DEPTHS TO WATER-BEARING ZONES IN BEDROCK

Scale 1:250,000

1 inch equals approximately 4 miles

5 0 5 10 Miles

5 0 5 10 Kilometres

LEGEND

PALAEOZOIC

DEVONIAN

MIDDLE DEVONIAN

- DETROIT RIVER GROUP: limestone and dolomite

LOWER DEVONIAN

- BOIS BLANC FORMATION: dolomite and limestone

SILURIAN

UPPER SILURIAN

- BASS ISLAND FORMATION: dolomite
- SALINA FORMATION: dolomite, shale and gypsum

MIDDLE SILURIAN

- GUELPH FORMATION: dolomite

Geologic boundary, approximate

Bedrock surface elevation contour, interval 25 feet (All elevations in feet above mean sea level)

References:

Bedrock topography interpretation by A. Hickinbotham ; bedrock geology after Sanford (1969)

Cowan, W. R., 1972, Pleistocene geology of the Brantford area, southern Ontario: Ont. Dept. Mines and Northern Affairs, Ind. Min. Repl. 37

Hewitt, D.F., and Liberty, B.A., 1972, Palaeozoic geology of southern Ontario: Ont. Div. Mines, Map 2254

Karrow, P.F., 1963, Bedrock topography of the Brantford area, southern Ontario: Ont. Dept. Mines, Map 2035

_____ 1963, Pleistocene geology of the Hamilton-Galt area, Ontario: Ont. Dept. Mines, Geol. Repl. 16

Ontario Ministry of the Environment, 1974, Ground water probability, County of Haldimand: Water Resour. Map 3112

Sanford, B. V., 1969, Geology of the Toronto-Windsor area, Ontario: Geol. Surv. Can., Map 1263A

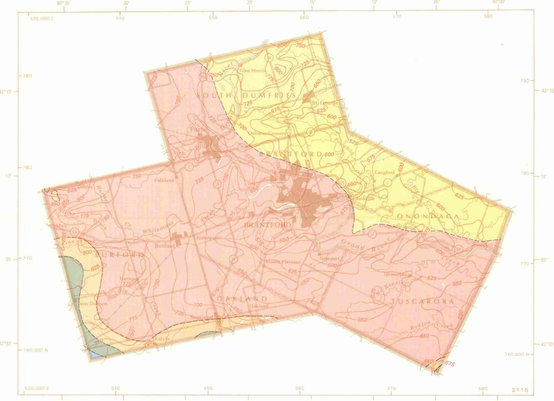
_____ 1964, Haldimand county and parts of Brant, Wentworth and Lincoln counties, Ontario: Geol. Surv. Can., Map 53-30

Sibul, U., 1969, Water resources of the Big Otter Creek drainage basin; Ont. Water Resour. Comm., Water Resour. Repl. 1

Yakutchik, T.J., and Lammers, W., 1970, Water resources of the Big Creek drainage basin

Bedrock surface elevations derived from water-well records on file with the Ministry of the Environment up to the end of 1972

Cartography by B. Fischer



Map 7

BEDROCK GEOLOGY AND TOPOGRAPHY

Scale 1:250,000

1 inch equals approximately 4 miles

5 0 5 10 Miles

5 0 5 10 Kilometres

Ontario
MINISTRY OF THE ENVIRONMENT
Water Resources Branch

COUNTY OF BRANT

Map 3100

GROUND WATER PROBABILITY

Sheet 2

WATER SUPPLIES IN BEDROCK

INORGANIC CHEMICAL ANALYSES OF GROUND-WATER SAMPLES

Table 1. Inorganic Chemical Analyses—Overburden Wells within 60 Feet of Surface
(sample locations shown on Map 1)

Sample or Well No.	Sampling Date	H_2S in Field (mg/l)	pH in Field	pH in Lab	Constituents in milligrams per litre (mg/l)											Total Alkalinity (mg/l $CaCO_3$)	Total Hardness (mg/l $CaCO_3$)	Total Dissolved Solids (mg/l)	Specific Conductance in Field (mmhos/cm^3 at 25°C)	Specific Conductance in Lab (mmhos/cm^3 at 25°C)
					Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Boron (B)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (N)					
029	–/5/64	–	–	7.6	0.09	119	24	7*	–	–	291	90	23	–	–	291	396	735	–	–
170	–/5/64	–	–	7.8	0	54	20	0*	–	–	–	25	8	–	–	149	218	362	–	–
262	25/6/73	5	7.5	7.1	0.15	504	158	111	4.7	1.66	34	2000	99	1.4	0.03	28	1940	2907	4000	3200
303	3/7/73	–	7.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	650	–
384	–/5/64	–	–	7.9	0	64	19	9*	–	–	–	65	8	–	–	192	240	290	–	–
603	24/5/73	–	7.4	7.6	<0.05	74	27	3	1	<0.01	251	50	7	0.1	5.0	206	296	318	616	–
613	17/7/64	–	–	7.6	1.60	168	25	11	–	–	242	341	8	–	0	198	524	683	–	820
622	17/7/64	–	–	7.7	1.48	54	20	9	–	–	274	42	3	–	0	224	218	274	–	350
668	28/6/73	Trace	7.5	8.1	0.05	32	33	16	1.4	0.16	269	30	4	0.9	0.07	221	216	467	700	450
676	24/7/64	–	–	7.7	0.81	64	20	4	–	–	215	53	6	–	2	176	242	272	–	390
679	17/7/64	–	–	7.5	2.90	115	18	4	–	–	318	108	13	–	Trace	260	364	427	–	530
796	27/6/73	Trace	7.5	7.6	1.9	130	31	6	1.1	<0.01	212	280	4	0.3	0.18	174	452	569	1300	810
859	3/7/73	–	7.0	7.2	0.05	114	36	11	1.3	<0.01	418	110	4	<0.01	0.47	343	432	494	1500	780
939	5/7/73	–	7.5	7.6	0.10	73	28	7	7.3	<0.01	284	40	13	<0.01	6.5	233	296	347	600	580
1191	26/6/73	–	7.5	7.5	0.15	142	130	64	4.5	<0.01	639	440	41	0.4	4.0	524	890	1164	3000	1480
1608	4/7/73	–	7.5	7.3	0.15	86	45	22	5.3	<0.01	493	49	8	<0.1	2.8	405	400	483	1500	800
99970	–/5/64	–	–	7.6	0.17	92	27	11*	–	–	–	90	60	–	–	203	342	412	–	–
99971	–/5/64	–	–	7.9	0.09	24	44	10*	–	–	–	45	12	–	–	199	230	284	–	–
99972	26/6/73	–	7.6	7.7	0.10	176	61	93	4.9	<0.01	420	220	148	0.1	39.0	345	690	1093	2250	1650
99973	3/7/73	–	7.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	750	–
99975	26/7/73	–	7.5	7.8	0.45	97	64	47	9.9	<0.01	373	160	121	0.1	1.2	306	520	698	2200	1180
99977	6/7/73	–	7.3	7.3	<0.05	90	35	8	23	<0.01	368	55	16	<0.1	9.7	302	368	461	1300	740
99980	5/7/73	–	7.5	7.8	<0.05	79	16	3	1.0	<0.01	264	30	10	<0.1	4.7	217	264	300	850	510
99983	27/6/73	–	7.5	7.3	<0.05	82	21	4	1.0	<0.01	226	95	10	0.1	4.2	186	292	353	850	560
99984	24/5/73	–	7.5	7.3	<0.05	146	43	42	9.5	<0.01	384	74	176	0.1	1.3	315	540	695	1460	–
99986	25/5/73	–	7.6	7.3	<0.05	142	23	173	18	<0.01	343	48	319	0.1	18.0	282	452	982	2400	–
99987	29/6/73	–	7.5	7.4	0.05	119	31	82	2.1	–	319	55	156	0.1	21.0	262	424	709	2000	1210
99990	27/6/73	–	7.0	7.6	<0.05	117	26	14	1.5	<0.01	330	100	41	0.1	4.4	271	400	492	1400	800
99991	3/7/73	–	7.4	7.5	0.15	99	17	22	3.3	<0.01	278	80	20	<0.1	10.0	228	316	433	1100	690
99994	26/6/73	–	7.5	7.8	0.05	98	34	33	4.0	<0.01	371	100	32	0.1	5.6	305	384	519	950	840
99996	25/6/73	–	8.0	7.7	0.10	236	174	80	4.9	0.73	67	1000	41	0.6	0.39	55	980	1582	2250	1850
99997	28/6/73	–	7.1	7.3	<0.05	108	28	34	6.2	<0.01	312	95	74	0.1	7.1	256	388	540	1410	900
99998	28/6/73	–	7.5	7.7	<0.05	80	31	4	2.2	<0.01	263	67	14	0.1	12.0	216	328	391	940	630
99999	25/6/73	–	7.6	7.4	1.2	96	21	22	2.8	<0.01	224	120	23	0.1	13.0	184	328	464	1000	740

*includes potassium

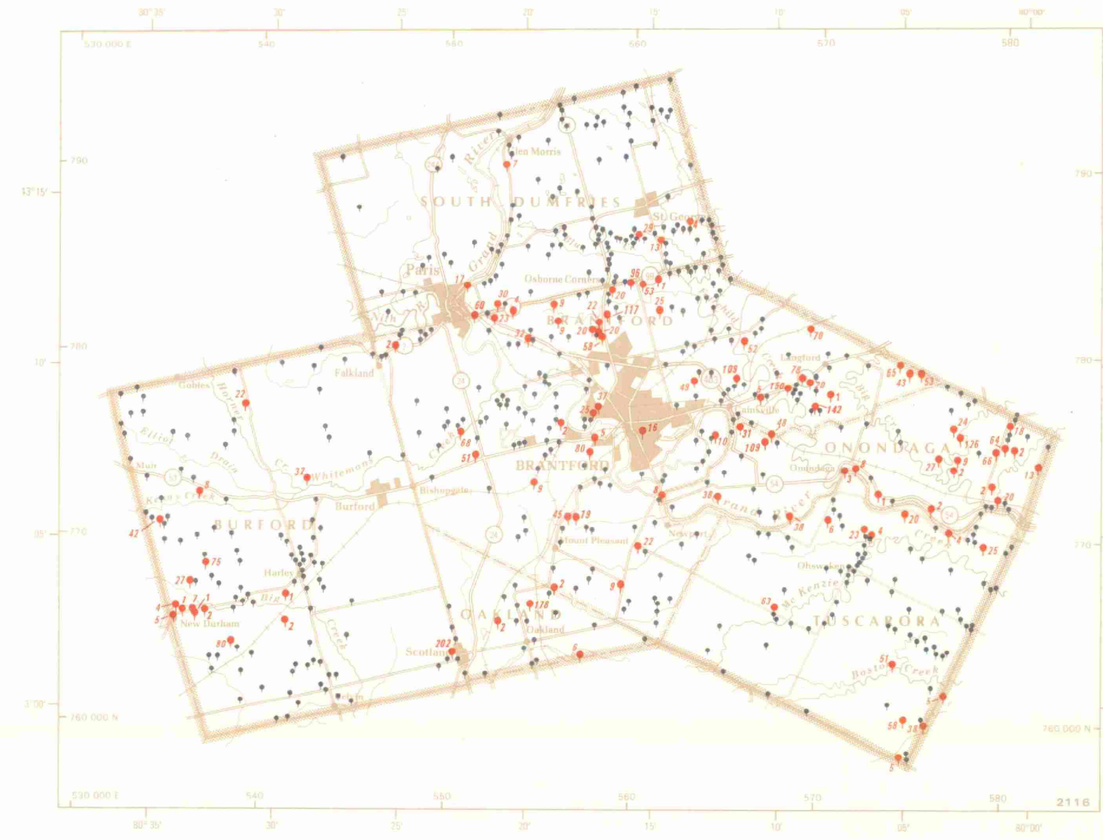
Table 2. Inorganic Chemical Analyses—Overburden Wells between 60 Feet from Surface and Bedrock
(sample locations shown on Map 2)

Sample or Well No.	Sampling Date	H_2S in Field (mg/l)	pH in Field	pH in Lab	Constituents in milligrams per litre (mg/l)											Total Alkalinity (mg/l $CaCO_3$)	Total Hardness (mg/l $CaCO_3$)	Total Dissolved Solids (mg/l)	Specific Conductance in Field (mmhos/cm^3 at 25°C)	Specific Conductance in Lab (mmhos/cm^3 at 25°C)
					Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Boron (B)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (N)					
023	–/5/64	–	–	7.6	4.15	95	35	15	–	–	–	188	10	–	–	237	380	499	–	–
072	24/5/73	–	7.6	7.4	0.15	99	26	7	1	<0.01	285	37	50	0.1	5.4	234	356	395	800	–
222	–/5/64	–	–	7.7	0.23	256	44	60	–	–	–	775	28	–	–	235	820	1314	–	–
301	–/5/64	–	–	7.8	0.05	92	45	170	–	–	–	320	520	–	–	90	416	1211	–	–
366	–/5/64	–	–	7.9	2.6	123	25	13	–	–	–	195	18	–	–	230	408	525	–	–
414	–/5/64	–	–	7.4	3.4	550	128	110	–	–	–	2050	62	–	–	154	1900	3006	–	–
515	29/6/73	–	7.5	7.5	0.10	125	27	19	2.6	<0.01	347	120	42	<0.1	0.78	285	424	520	1450	830
560	28/6/73	–	7.1	7.6	<0.05	104	20	10	1.3	<0.01	314	50	18	0.1	5.0	258	344	390	950	660
608	28/6/73	–	7.5	7.5	3.1	476	53	32	1.8	0.96	81	1400	2	1.2	0.01	67	1410	2020	3500	2150
656	17/7/64	–	–	7.6	1.27	98	23	6	–	–	293	91	15	–	Trace	240	340	388	–	520
664	24/7/64	–	–	7.3	5.9	386	100	8	–	–	183	1180	10	–	0	150	1380	1790	–	1600
694	28/6/73	–	7.3	7.4	<0.05	97	21	4	1.6	<0.01	285	89	10	0.1	2.0	234	330	382	910	600
708	27/6/73	–	7.5	7.6	<0.05	80	30	10	42.0	<0.01	308	78	20	0.1	11.0	253	324	461	1500	740
803	27/6/73	–	7.5	8.0	0.15	61	27	3	1.0	<0.01	224	63	6	0.1	5.0	184	272	304	900	500
994	5/7/73	Trace	7.5	7.3	3.0	89	25	5	1.0	<0.01	362	30	9	<0.1	0.02	297	326	350	1100	590
1060	6/7/73	–	7.4	7.6	2.2	71	28	5	1.0	<0.01	332	27	4	0.5	0.03	273	294	313	930	530
1076	5/7/73	–	7.5	7.7	<0.05	67	27	10	1.0	<0.01	317	38	5	<0.1	0.2	260	280	315	950	520
1089	6/7/73	–	7.4	7.5	0.95	69	29	5	1.0	<0.01	330	28	2	0.3	0.04	271	292	308	960	530
1238	26/6/73	–	7.5	7.6	0.45	75	23	3	1.7	<0.01	252	89	5	0.1	0.02	207	294	332	890	540
1288	4/7/73	–	7.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1500	–
1564	3/7/73	–	7.4	7.3	0.15	126	34	13	18	<0.01	432	100	18	<0.1	6.2	355	456	560	1600	880
99974	24/5/73	–	6.9	7.7	2.5	74	18	3	1.0	<0.01	274	46	2	0.4	0.04	225	260	292	550	–
99976	5/7/73	–	7.3	7.2	<0.05	90	16	4	<1.0	<0.01	310	38	3	<0.1	0.68	255	292	317	670	530
99978	6/7/73	–	7.5	7.4	<0.05	84	35	6	<1.0	<0.01	330	60	10	<0.1	5.9	271	354	384	900	650
99988	27/6/73	–	7.5	7.8	<0.05	69	32	2	1.0	<0.01	221	89	8	0.1	7.1	182	304	352	800	560
99992	4/7/73	–	7.0	7.2	0.05	220	56	46	2.1	<0.01	513	260	99	0.2	19.2	421	780	1030	3000	1540

Table 3. Inorganic Chemical Analyses—Bedrock Wells
(sample locations shown on Map 5)

Sample or Well No.	Sampling Date	H_2S in Field (mg/l)	pH in Field	pH in Lab	Constituents in milligrams per litre (mg/l)											Total Alkalinity (mg/l $CaCO_3$)	Total Hardness (mg/l $CaCO_3$)	Total Dissolved Solids (mg/l)	Specific Conductance in Field (mmhos/cm^3 at 25°C)	Specific Conductance in Lab (mmhos/cm^3 at 25°C)
					Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Boron (B)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (N)					
059	24/5/73	–	7.5	7.5	1.4	118	30	19	1.1	<0.01	426	85	32	0.1	1.2	350	420	582	890	–
060	–/5/64	–	–	7.7	0.1	94	26	20*	–	–	–	105	14	–	–	288	342	442	–	–
060	24/5/73	–	7.6	7.6	0.15	114	29	10	2.4	<0.01	284	152	26	0.1	3.4	233	404	499	980	–
138	4/7/73	–	7.8	7.4	2.4	130	55	8	1.4	<0.01	260	350	6	0.6	0.08	213	556	692	1400	950
160	–/5/64	–	–	7.9	0.83	60	33	12*	–	–	–	60	13	–	–	246	284	336	–	–
160	24/5/73	2	7.4	7.5	1.8	75	26	4	1.0	<0.01	281	50	7	0.5	0.02	231	296	314	660	–
164	–/5/64	–	–	7.9	2.3	55	26	6*	–	–	–	4	4	–	–	255	246	260	–	–
169	–/5/64	–	–	7.8	0.03	68	17	4*	–	–	–	50	12	–	–	179	240	268	–	–
228	–/5/64	–	–	7.7	0.90	223	57	150*	–	–	–	1320	6	–	–	89	816	1820	–	–
275	–/5/64	–	–	7.9	0.69	546	43	366*	–	–	–	2570	34	–	–	221	1540	3702	–	–
283	6/7/73	–	7.3	7.4	1.5	528	112	68	5.5	<0.01	92	1860	13	1.4	0.08	76	1780	2645	1400	2650
305	–/5/64	–	–	7.8	0.36	216	88	168	–	–	–	745	450	–	–	204	902	1800	–	–
320	4/7/73	–	7.8	7.7	0.40	33	19	90	2.5	0.50	107	118	122	1.6	0.07	88	164	450	1400	800
326	24/5/73	–	7.9	8.1	0.15	53	34	100	1.7	0.48	62	370	58	1.4	0.02	51	272	659	1225	–
344	–/5/64	–	–	7.9	1.76	70	20	17*	–	–	–	50	18	–	–	242	260	332	–	–
392	25/6/73	0.5	7.5	7.5	1.6	508	110	120	8.3	1.39	63	1860	47	1.4	0.01	52	1720	2699	3700	2900
429	25/6/73	–	7.5	7.6	0.70	496	135	108	4.3	1.66	37	2000	13	1.2	0.04	31	1800	2789	3500	3000
452	–/5/64	–	–	7.6	2.28	225	43	13*	–	–	–	590	23	–	–	162	730	1007	–	–
452	28/6/73	Trace	7.5	7.4	2.9	128	29	19	1.6	0.73	110	320	57	0.5	0.01	91	440	623	1500	900
457	–/5/64	–	–	7.7	0.93	93	26	24*	–	–	–	132	21	–	–	267	338	467	–	–
460	–/5/64	–	–	7.6	0.79	186	32	35	–	–	–	465	33	–	–	205	594	815	–	–
460	28/6/73	–	–	7.2	3.2	170	42	24	1.6	<0.01	210	420	40	0.7	0.01	173	600	885	2050	1140
473	29/6/73	–	7.4	7.6	0.85	452	67	14	1.3	<0.01	201	1300	4	1.8	0.20	165	1490	1971	3500	2150
516	29/6/73	Trace	7.4	7.9	0.05	43	35	33	8.5	<0.01	267	120	39	0.1	20.0	219	368	509	1400	880
612	28/6/73	–	7.5	7.7	0.05	70	20	7	4.3	<0.01	275	46	6	0.1	0.19	226	260	300	750	500
637	28/6/73	Trace	7.5	7.8	2.6	51	20	9	1.1	<0.01	273	16	3	0.5	0.01	224	220	248	730	430
639	17/7/64	–	–	7.8	2.35	51	18	14	–	–	252	13	3	–	Trace	206	204	235	–	330
642	17/7/64	–	–	7.8	1.45	65	16	6	–	–	220	58	4	–	0	180	230	268	–	350
686	17/7/64	–	–	8.0	0.70	32	20	28	–	–	227	20	2	–	0.1	186	162	225	–	320
715	27/6/73	–	7.0	7.4	<0.05	82	28	3	25.0	<0.01	354	35	6	0.1	6.6	291	320	393	1010	650
728	17/7/64	–	–	8.1	0.71	44	16	39	–	–	127	133	1	–	0	104	176	306	–	420
824	3/7/73	–	–	7.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2000	–
825	4/7/73	–	7.5	7.2	0.30	66	19	26	1.2	<0.01	189	64	61	0.4	1.5	155	244	348	960	600
830	3/7/73	–	7.5	7.3	0.05	136	32	6	1.0	<0.01	314	120	12	<0.1	24	258	472	578	1600	880
864	3/7/73	1.0	7.0	7.2	5.5	98	15	27	3.3	<0.01	223	135	21	0.1	0.13	183	308	425	1300	660
879	–/5/64	–	–	7.8	0.34	513	136	130*	–	–	–	2175	40	–	–	58	1840	3039	–	–
870	24/5/73	–	7.4	7.1	2.1	320	100	8	1.5	<0.01	252	1000	10	1.7	0.03	207	1210	1578	2000	–
980	5/7/73	–	7.4	7.4	1.40	192	68	5	1.0	<0.01	275	540	6	1.0	0.08	226	760	959	2300	1220
1052	5/7/73	Trace	7.3	7.5	0.65	76	27	5	1.0	<0.01	318	45	4	<0.1	0.02	261	300	325	910	550
1189	26/6/73	–	7.0	7.3	0.05	130	39	8	2.1	<0.01	381	180	6	0.9	1.1	313	484	569	1000	880
1221	26/6/73	5.0	7.5	7.5	0.65	492	144	139	11.0	2.82	62	2100	9	2.6	0.02	51	1840	2942	5000	3050
1232	26/6/73	0.1	7.0	7.3	2.00	396	41	13	2.5	<0.01	352	900	12	0.4	0.62	289	1160	1550	3200	1800
1329	4/7/73	2.0	7.0	6.6	33.0	488	180	295	14.0	–	28	1600	770	0.7	0.19	23	1960	3405	–	4350
1412	28/6/73	.5	7.5	8.0	0.05	40	19	22	1.4	0.18	225	48	3	1.3	0.01	185	180	256	650	425
99981	4/7/73	Trace	7.3	8.1	0.65	30	14	72	3.4	0.56	98	110	79	1.7	0.03	81	132	370	1500	640
99982	28/6/73	–	7.5	7.9	0.15	40	22	17	1.4	0.14	234	38	4	0.8	0.02	192	192	249	750	425
99985	24/5/73	4.0	7.5	7.8	<0.05	21	8	51	4.0	0.50	152	74	3	2.6	<0.01	125	86	249	–	–
99989	27/6/73	–	7.5	7.4	0.45	284	75	27	1.9	0.61	182	840	28	0.9	0.25	150	1020	1359	2700	1650
99995	26/6/73	–	7.5	7.7	0.45	87	30	11	4.5	<0.01	207	150	22	0.2	0.01	170	318	417	750	630

*includes potassium



Map 8

SULPHUROUS WATER IN BEDROCK WELLS

Scale 1:250,000

1 inch equals approximately 4 miles

5 0 5 10 Miles

5 0 5 10 Kilometres

LEGEND

58 — Bedrock well with reported sulphurous water, depth from bedrock surface to sulphurous water-bearing zone (in feet)

Bedrock well with no reported sulphurous water

Note: "sulphurous" water usually denotes the presence of hydrogen sulphide gas; high concentrations of sulphates (SO_4) may also be present

References:

Map compilation and interpretation by A. Hickinbotham and V. Novicki

Hydrogeologic information derived from water-well records on file with the Ontario Ministry of the Environment up to the end of 1972

Cartography by B. Fischer

Ontario
MINISTRY OF THE ENVIRONMENT
Water Resources Branch

COUNTY OF BRANT

Map 3100

GROUND WATER PROBABILITY

Sheet 3

GROUND WATER QUALITY